The Journal of

THE AUSTRALIAN INSTITUTE OF AGRICULTURAL SCIENCE

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Literary matter for publication should be in double-spaced typing, and should be forwarded to the nearest member of the editorial committee. Original papers must not be unduly long, and tables and photographs should be reduced to a minimum. All contributions must be lodged with the Editor not later than the first day of February, May, August, or November.

VOL. 1, No. 1. MARCH, 1935

THE PRESIDENT'S MESSAGE

For some time past, agricultural scientists in the Departments of Agriculture, the Universities and commercial organisations have felt the need of an organisation, Commonwealth-wide in scope, through which the views of the profession could be expressed. Thanks to the initiative of the Sydney University Agricultural Graduates' Association, a proposal was submitted to kindred societies throughout Australia for the establishment of an organisation similar in scope and character to that of other professional bodies, such as those associated with the practice of medicine, chemistry, engineering, veterinary science, etc.

The proposals submitted by the Sydney group of workers were thoroughly discussed by other agricultural scientific societies with the result that delegates were appointed and empowered to form an Australian Institute of Agricultural Science. The Institute was formally established on 17th January, 1935, and in this delightful environment of the Melbourne Botanic Gardens, prospective members are privileged to hold the inaugural meeting.

* Address delivered by Professor A. E. V. Richardson, at the inaugural meeting of the Institute on January 22, 1935.

I deeply appreciative the great honour which my fellow workers in agricultural science have conferred upon me in electing me as President of their Council, and I am not unmindful of the magnitude of the task which confronts us in establishing and maintaining an Institute which will adequately serve the needs of agricultural science in Australia. With the active help and sympathetic co-operation of our fellow workers throughout the Commonwealth, the aims of the founders of the Institute will gradually be realised.

Twenty-five years ago it would have been impossible to have held a meeting such as is gathered here to-night. At that time the study of agricultural science at Australian Universities was just beginning. To-day, more than three hundred graduates are engaged in the task of assisting agricultural progress in Australia.

The main objectives of the Institute are to promote the advancement of agricultural science and to further the interests of agriculture in Australia; to encourage a national policy of agricultural research, and the interchange of ideas between research workers in agricultural science; and broadly, to promote the welfare of the profession and raise its status in the community.

The astonishing progress of scientific research and its application to all forms of production, together with the development of labor-saving machinery, have resulted in an amazing increase in agricultural efficiency throughout the world. Broadly speaking, the problem of scarcity has been conquered, but mankind has yet to develop a technique for handling the problem of abundance, and to find a solution of the problems of distribution.

Whatever may be the result of the policies of restriction of output which are exercising the minds of British and foreign statesmen at the present time, there can be no question that our primary industries must be conducted with the maximum of efficiency if they are to compete successfully with similar industries in other countries. Pending the restoration of world demand, the most practicable method of achieving this result is to reduce production costs and exploit every avenue for applying science to production. The more intensive use of land already settled, or partially settled, would result in greater production at less cost than the expansion of settlement, which has been such a prominent feature of Government policy during the post-war period.

The results of scientific research in agriculture are not spectacular. Like the slow working of Nature herself, they need time for fruition, and are absorbed almost imperceptibly into agricultural practice unless agricultural extension methods are well organised and thorough.

The Constitution provides for the holding of periodical meetings of the Institute with frequent meetings of the local branches, and for the publication of a journal which it is hoped will be an important factor in retaining the interest of members in the affairs of the Institute and in recording the activities of the various centres.

The major work of the Institute will be the development of an esprit de corps among the members of the profession throughout the Commonwealth, and in assisting in the formation of a public opinion which will insist that the agricultural and pastoral resources of Australia should be developed by the best known methods and utilised to the best advantage attainable.

In the field of agricultural research and its application to practice, members of the Institute will have great opportunities for rendering service to the community.

The Australian Institute *of* Agricultural Science

MEETING OF DELEGATES TO FINALISE CONSTITUTION

The first concrete move towards forming an Australian federation of agricultural scientists was made on August 21, 1933, when Mr. G. de Vahl Davis, B.Sc.Agr., addressed the Sydney University Agricultural Graduates' Association on the desirability of establishing such a body, and presented before members a tentative constitution which, with modifications subsequently effected by a special committee and by the Association, formed the basis for discussion among agricultural scientific workers throughout Australia. The matter was taken up whole-heartedly in Canberra and each of the States, and valuable amendments to the original draft were suggested from the various centres. The preliminary negotiations—extending over 17 months—were conducted through the S.U.A.G.A.

Finally, during the course of the A.N.Z.A.A.S. Congress, a meeting of delegates was held in the School of Agriculture, Melbourne University, on January 17, 1935, to discuss various constitutional points in connection with the formation of the Institute, and to decide upon the final draft of the Memorandum and Articles of Association. Scientific bodies represented at the meeting were : The Melbourne University Agricultural Society; The Sydney University Agricultural Graduates' Assoc.; The Agricultural Sciences' Club of the Waite Research Institute, S.A.; and the Agricultural Scientists' Assoc. of Western Australia. Agricultural scientific workers in Canberra, Queensland and Tasmania were also represented. Mr. G. de V. Davis, of Sydney, acted as chairman and Mr. A. J. Vasey, of Melbourne, as conference secretary. The meeting lasted from 8 p.m. to 1.35 a.m.

The 20 delegates who participated in the discussion were :

Canberra: Dr. B. T. Dickson, Dr. I. M. Mackerras, Mr. G. A. Currie.

New South Wales: Professor R. D. Watt, Mr. G. de V. Davis, Mr. E. T. Edwards, Mr. H. J. Hynes.

Victoria: Mr. A. J. Vasey, Mr. F. M. Read, Mr. W. B. Miller, Mr. A. B. Hackwell. (Professor S. M. Wadham was present in an unattached advisory capacity).

S. Australia: Dr. I. F. Phipps, Mr. H. C. Trumble, Mr. C. S. Piper, Dr. J. G. Davies.

Queensland: Professor and Mrs. J. K. Murray.

W. Australia: Mr. H. G. Andrewartha, Mr. A. J. Roberts.

Tasmania: Mr. E. F. Fricke.

At the outset of the meeting, the formal motion—"that this group of persons is in favour of the formation of the Australian Institute of Agricultural Science"—was carried enthusiastically.

Each clause in the proposed Memorandum and Articles of Association was then taken seriatim, and modifications were made where necessary. It was agreed that the Office of Management should be in Melbourne and that the journal should be edited and published in Sydney; it is probable that the Registered Office of the Institute will be in Canberra. The meeting accepted the offer of S.U.A.G.A. to hand over as a going concern the journal "Suaga," the name and policy of which to be changed as the Council should deem fit. Delegates were of the opinion that the Institute's journal should not be devoted exclusively to research papers, but that the policy should be to incorporate leading articles, reviews of present states of knowledge in various subjects, articles of general interest to members, short advance accounts of research work completed, proceedings of Council and of local branches, and items of a personal and general nature. A sub-committee was then appointed to decide upon a name for the journal. The question of a crest for the Institute was also considered.

The Constitution as finally adopted by the delegates will later be published in pamphlet form, but not until it has passed through solicitors' hands. Some of the important points from the Articles of Association, bearing on qualifications for membership, fees, etc., are set out in the final pages of this issue.

At the conclusion of the meeting, the following office-bearers were elected for the ensuing two years :—

President: Professor A. E. V. Richardson, M.A., D.Sc.

Hon. Secretary: Mr. A. J. Vasey, B.Agr.Sc.

Hon. Treasurer: Mr. R. L. Twentyman, B.Agr.Sc.

Editor of Journal: Mr. H. J. Hynes, M.Sc., B.Sc.Agr.

Business Manager of Journal: Mr. E. T. Edwards, B.Sc.Agr.

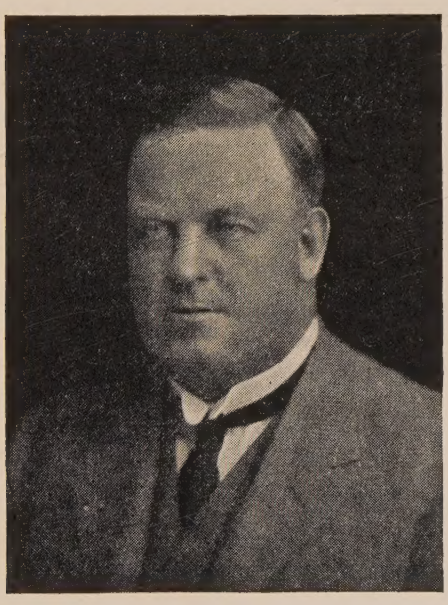
Executive Committee: Mr. J. Brake, B.Agr.Sc.; Mr. F. M. Read, M.Agr.Sc.; Mr. W. B. Miller, M.Agr.Sc.; Mr. A. B. Hackwell, B.Agr.Sc.

Vice-Presidents, members of Council and sub-editors have yet to be appointed by local branches of the Institute.

BIOGRAPHICAL NOTES

PRESIDENT

The election of Professor A. E. V. Richardson as first President of the Institute will be widely acclaimed both as one which was merited and as one which will redound to the welfare of the Institute itself. There is no more outstanding figure in Australian agricultural science than Dr. Richardson, and he brings to the new office a background of experience in academic, research and



Professor
A. E. V. RICHARDSON,
M.A., D.Sc.
First President of the
Australian Institute of
Agricultural Science.

administrative work, which will prove invaluable in the deliberations of the Council and Executive Committee.

He was born at Adelaide, S.A., in 1883, and received his agricultural college education at Roseworthy. He graduated M.A. in the University of Adelaide in 1910 and was awarded the D.Sc. (Agric.) degree by the Melbourne University in 1924. He has held the dual position of Waite Professor of Agriculture and Director of the Waite Agricultural Research Institute, University of Adelaide. since 1924, and formerly was Superintendent of Agriculture in Victoria (1911-1924) and Dean of the Faculty of Agriculture at Melbourne (1919-1924). In 1918 he visited the United States and Canada to study systems and methods of agricultural education and research; in 1927 he represented Australia at the

first Imperial Agricultural Research Conference in London; and in 1932 he was Official Adviser on Agriculture to the Australian Delegation at the Imperial Economic Conference, Ottawa. Professor Richardson is a member of the Executive Committee of the Commonwealth Council for Scientific and Industrial Research; a foreign member of the Czechoslovak Academy of Agriculture; and an active member of numerous other committees and bodies connected with agriculture.

SECRETARY

Mr. A. J. Vasey was born in 1904 at Auburn, Vic., and was educated at the Camberwell Grammar School, the Longerenong Agricultural College, and Melbourne University. He graduated B.Agr.Sc. in 1925, and from January to June, 1926, was Assistant Scientist to the Mildura Vineyards Protection Board. He was Science Field Officer at the State Research Farm, Werribee, from 1926 to 1929, and during the past six years has been Cereal Research Officer—which post he still holds—at the same institution. He is the co-author, with Mr. H. C. Forster, of several publications dealing with field experimentation and the application of the census method to the study of the growing crop. He was the joint Hon. Secretary of the Agricultural and Forestry Section of the A.N.Z.A.A.S. Congress, held at Melbourne in January last.

TREASURER

Mr. R. L. Twentyman was born in 1903 at Melbourne, and was educated at Scotch College and the University—graduating B.Agr.Sc. in 1925. He then joined the Field Branch of the Victorian Dept. of Agriculture, and in 1929 was deputed to study the response of pastures to sulphate of ammonia; he has supervised the field work connected with the Victorian Pasture Improvement League scheme initiated in 1932. In 1931 he was temporarily appointed Agrostologist in the State Department, and this appointment was made permanent last year. He was one of the small group of undergraduates who at Werribee in 1922 decided to form the Melbourne University Agricultural Society, to which body he has acted as Hon. Auditor for some years.

EDITOR

Mr. H. J. Hynes was born in 1900 at Moree, N.S.W., and received his education at Fort St. High School, Sydney University and Minnesota University, U.S.A.—graduating B.Sc.Agr. in 1923 and M.Sc. in 1925. He has held the Walter and Eliza Hall Agriculture Research Fellowship, and in 1927 was

appointed to the position he still holds—Senior Assistant Biologist in the N.S.W. Dept. of Agriculture; his investigations have been mainly concerned with root-rot diseases of cereals. He was Secretary-Treasurer of the Sydney University Agricultural Graduates' Assoc. from 1929 to 1932, and was Editor of the Association's journal, "Suaga," during the six years in which it was published.

BUSINESS MANAGER

Mr. E. T. Edwards was born in 1905 at Armidale, N.S.W., and received his education at the Armidale High School and Sydney University—graduating B.Sc.Agr. in 1928. He then joined the Dept. of Agriculture as Assistant Biologist and still holds this position. His investigations have been concerned mainly with diseases of maize and lucerne, and extensive papers dealing with root-rot diseases of maize and witches' broom of lucerne are now in course of preparation. He has been Hon. Secretary of the Sydney University Agricultural Graduates' Association since 1932, and was Business Secretary of "Suaga" in 1933-34.

INAUGURAL MEETING OF THE INSTITUTE

The inaugural meeting of the Australian Institute of Agricultural Science was held in the Melbourne Botanic Gardens on the evening of January 22, 1935, as part of a joint function at which the Melbourne University Agricultural Society entertained visiting members of the Agriculture and Forestry Section of the Australian and New Zealand Association for the Advancement of Science. No more enchanting spot could have been chosen for the "At Home," and it was indeed a happy thought of the Melbourne Society to arrange for a gathering of this kind. There were 150 guests present, and there was every opportunity for informal conversations. After Mr. W. B. Miller, President of the Society, had spoken a few words of welcome, a short address was delivered by Professor A. E. V. Richardson, first President of the Institute; his address is published in the foregoing pages. During the evening, Mr. F. J. Rae, Director of the Gardens, showed the guests over the new National Herbarium. The function terminated with supper and short speeches by Professors J. K. Murray and S. M. Wadham.

Agricultural Science in the Soviet Union

by

PROFESSOR J. A. PRESCOTT, D.Sc.

Waite Agricultural Research Institute, South Australia

Since the introduction of planned production by the Soviet Union in 1928, the social structure of Russian agriculture has been considerably modified from its original peasant status. At the same time, agricultural institutes have been re-organised and their work co-ordinated to assist in the new movement.

Prior to the revolutions of 1917, there had been a trend from large holdings in the hands of relatively benevolent proprietors to smaller holdings in the hands of individual farmers employing a number of labourers. These new farmers, being of a thrifty disposition and having paid rather heavily for the privilege of owning their own land, were not in a position to play the part of the lord of the manor, and so acquired a reputation as "hard fists" or *kulaks,* an expression which recent Russian history has made familiar to the rest of the world. Attempts at communal farming soon followed the revolution, but these were of the type with complete communism such as have been developed amongst certain Zionist groups in Palestine. In 1928, however, a drive began both by the Soviet Government and by the landless labourers towards the liquidation of the kulak class and the general collectivisation of all the farms of the country, so that at the present time something over 90 per cent. of the farmers are in collective farms.

In addition to these collectives a group of State farms or grain factories was developed, particularly on very large estates or in the more arid undeveloped pastoral regions, and over 200 had already been formed in 1931, some with exceedingly large and entirely unmanageable areas. While technically, agricultural science should have been immediately applicable in these cases, the human factor, the lack of knowledge of rotational systems on mechanised farms, and the shortage of grazing stock have all militated against the complete success of the giant farms, and most of them have already been subdivided and have lost their original identity.

The collective farms have been more successful in that no extreme theories of either State management or of communal living have been attempted, and family life has been well maintained. Collective farms vary somewhat in size, but in the German Volga Republic we were told that they averaged 5,000 acres and 100 families. Other records indicate one farm of 18,000 acres, 1,112 workers and 630 families; another of 3,700 acres, 461 workers and 212 families; and a third with 520 workers and 208 households. These relative areas and numbers of families bear some relationship to the actual soil and rainfall conditions.

Collective farms do not usually own tractors or heavy harvesting machinery, these being hired from machine and tractor stations which may serve as many as 30 or 40 collectives. These centres actually form the nuclei of the advisory agricultural services, and the agronomists—one to about four collectives—are located at these stations. In this way, the scientific information and crop production programmes are brought to the farmers in a way that in the old days was well nigh impossible.

Research institutes and experimental farms were, of course, in being long before the revolution, and it is astonishing in a way that the revolution should have swept over them and left them intact. The workers suffered considerable hardships through lack of funds, even lack of fuel in winter, but since the systematic planning of production most of them have come into their own once again. At first, when they were instructed to devote the whole of their energies to the success of the plan and of collectivisation, fears were expressed that an end had come to original thought and scientific investigation, but the additional government support consequent upon the plan has made these fears groundless, and the workers are looking forward to a renewal of fundamental scientific activities. Each regional station, of which we visited two, that at Gorki and that at Saratov, devotes itself to the immediate problems of the locality,—a survey of peat and peat problems at Gorki, and of grain production at Saratov, where there is a range of very fine modern buildings. All the institutes have now been organised into a common body known as the "All Union Academy of Agricultural Sciences in the name of I.V. Lenin," of which Professor Vavilov is the President—virtually making him the director of agricultural science for the whole of the Soviet Union.

The Lenin Academy has for vice-presidents the directors of the Institute of Fertilisers and Soil Science, and of the Institute of Animal Husbandry, both of which are in Moscow. The headquarters of the Institute of Plant Industry are in buildings scattered about Leningrad, with the wheat collection and very fine library in a former palace on the old Nevsky Prospect. I found my way into another agricultural library nearby, probably one of the oldest in Europe, with some very fine old literature but with very little modern material,—an obvious survival of the old times.

The Soil Fertility Institute, now honouring the name of K. K. Gedroiz, the famous agricultural chemist, lies at some distance from the centre of Moscow and is devoting its attention to the *"Chemisation of Socialist Agriculture,"* as the journal issued by the Institute is called. This simply means the development of the use of artificial fertilisers. Intensive soil surveys in each province are carried out and the response to fertilisers worked out by chemical analysis, pot experiments and field experiments, of which some three to four thousand have been carried out in the last three years.

There are 23 sub-stations for the outside work, one for each agricultural province. A very large pot culture house was just being completed at the time of our visit; it was 120 metres long and would accommodate 12,000 pots.

The Institute of Animal Husbandry, again in the Moscow suburbs, also publishes a new journal, *"Problems in Animal Husbandry."* On a second visit to Moscow, I was fortunate enough to be able to visit this Institute and particularly the laboratory for artificial insemination, where work on the physiology of spermatozoa is being carried out. When the quality of stock is low, as in Russia to-day, the ability to transport semen from stud stock over long distances has become very important. Semen from rams and bulls has been kept viable for as long as 25 days, and over a distance of 1,200 kilometres. Nearly a million ewes have been treated in one year with an 83 per cent. success. With cattle, only a 60-65 per cent. success is reported.

One of the most interesting of the Russian institutes to the soil worker is one which is not agricultural in its origin; the Dokuchaev Soil Institute is a department of the Institute of Geology of the Academy of Sciences. It was moved from Leningrad to Moscow in September last. We were privileged to see the fine soil museum in its original home, but the chemical and physical laboratories were in process of packing up at the time of our visit. It was interesting to learn that Russia is now making practically all her own scientific glassware and laboratory equipment.

In the museum were exhibited a very complete range of soil monoliths with photographs of the associated country and specimens of the native vegetation. The work of this Institute is the starting point for the more detailed soil work of the local agricultural institutes, and nearly all of them have soil museums of the same type relating to purely local problems. One collective farm visited in the Ukraine had also its cottage museum with, amongst other things, four soil monoliths representing the principal soil types of the farm. This museum, a new rain gauge and thermometer screen, and an experimental garden were the pride of an elderly peasant who had been detailed by the village soviet to look after them.

Everywhere in Russia there is feverish educational activity which manifests itself in the enormous number of students passing through the agricultural colleges. Whole blocks of apartment houses have been built round most colleges and the associated institutes to accommodate these students and their families. On the Verblud State Farm, where there is an important station for the trial of agricultural machinery and of tractors, there are 800 students learning to be tractor drivers and mechanics. The peak was reached about three years ago when over 1000 students were handled at one time. Presumably earnestness and enthusiasm made up for any lack of efficiency and equipment in the early days. Some very fine equipment, however, is available at the present time.

The general impression is one of transition with some measure of stability in sight. Each year sees the publication of new journals all under the auspices

of the new academy. The correlation of the activities of all the separate research institutes into one academy is bound to result in greater efficiency and to raise the already high prestige of the scientific worker in the eyes of the Russian people.

The following are some periodical publications recently founded by the Lenin Academy of Agricultural Science: *The Chemisation of Socialist Agriculture* (monthly); *Problems of Animal Husbandry* (bi-monthly); *Bulletin of Plant Protection* (4 series); *Bulletin of Applied Botany, Genetics and Plant Breeding* (13 series).

Some Reflections upon Rural Relief and Agricultural Extension

by

E. R. Hudson, B.Sc., B.Ag., Dip.C.A.C.

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It is desirable to appreciate that over-production of foodstuffs is not an unlikely contingency as our appetites and powers of assimilation set a limit to the amount of food which we can use, but, on the other hand, a general over-production of the products of secondary industry and applied art cannot be readily visualised. Although there is an unlimited field for the application of human labour, and general over-production will probably never be attained, we are obliged to recognise that there is but limited scope for the effective application of energy in the realm of agriculture. In other words, with every advance in our material welfare the primary industries become of relatively less importance.

Given free play, the operation of economic laws should justify a country such as Australia in specialising in the primary industries up to the limits of economic production, but in spite of our natural advantages for primary production we are being forced to participate in the world-wide movement of labour from primary to secondary industry.

Many of the difficulties confronting agriculture can be attributed to a lag in the migration from primary to secondary industries, this movement not having kept pace with the development of improved methods in agriculture. This offers an explanation of the fact that although the rural problem has been accentuated by the existing monetary and economic crisis, it does not owe its origin thereto. To illustrate the point, reference may be made to the condition of American agriculture during the twenty years immediately preceding 1925. During this period the number of farm bankruptcies increased tenfold, although there was no increase in the percentage of failures in commerce (cf. *Annals, American Academy of Political and Social Science,* March, 1929). In the present connection, data relating to America are of special significance as throughout the greater part of its history that country has been largely self-supporting so far as agricul-

tural products are concerned, and consequently the trend of events is representative of the combined trends of the other countries of Western civilisation. The outstanding reason for the failure of American farm businesses was simply that there were too many people engaged in the industry.

From the social aspect it may be considered that rural life is preferable to urban and although much may be said in support of such a view, it is perhaps significant that there is a general tendency on the part of social reformers to prescribe country life for the other fellow.

There may be a certain measure of justification in looking to the land to provide employment for some of those at present unemployed, but besides important economic adjustments a drastically changed outlook would be involved, and under existing conditions a venture of this kind could easily miscarry. The introduction of shorter hours of labour on farms should result in the employment of more workers, but an eight-hour day would leave much free time which would tend to be burdensome to many farmers and farm-workers unless increased interest could be engendered in cultural pursuits. Education for leisure will be desirable if there is to be an appreciable reduction in the hours of toil. It would consequently appear necessary to make this a long-distance rather than an immediate objective of rural re-organisation.

Another possible avenue leading to increased employment on the land is the development of a demand for a greater proportion of luxury foods. As has already been indicated, the demand for food is considerably less elastic than for other articles, but, within limits, adjustment is possible.

A third possibility relates to the development of Eastern markets by encouraging a higher standard of living on the part of Asiatics. It is beyond question that at least for many years to come Asia could utilise all our surplus foodstuffs, but there cannot be a long-sustained one-way trade and we would be obliged to accept manufactured goods in return for primary products.

The opinion is advanced that under existing conditions it is futile to look to the land to provide a solution for unemployment unless the objective is to provide a field for labour without regard for its usefulness. If this be the case it is unnecessary to consider agriculture; there is plenty of sand which might be shifted. It is necessary to realise that the application of rural relief should not be associated with unemployment relief. Owing to the development of economic nationalism, the two are not directly compatible.

Recovery in the economic position of primary producers is more dependent upon a recovery in secondary industry than on any other factor, and although the two big branches of human endeavour have a reciprocal influence secondary industry is preponderant, and until it recovers farmers must expect difficult times. There is some reason to doubt whether society as it is at present constituted in the majority of countries can resolve the difficulties confronting it, and it is extremely difficult to see how an economic system based on interest can function

other than spasmodically. Crises such as we are now experiencing are inevitable if the world's interest bill, which,—as a direct consequence of the existing system —has tended to increase by geometrical progression in the preceding boom period, is to be reduced to a tolerable burden. This brings us to an additional point: Relief measures should embrace a reduction—permanent if possible—in the interest burden of farmers, if not of the community at large.

From the foregoing it should be clear that rural relief measures should avoid an increase in the numbers engaged in the industry, should tend to encourage the cultural training of young people in rural districts and should make some contribution to the problem of reducing interest rates. The need is for a consolidation rather than an expansion of the primary industries.

That there exists a case sufficiently strong to justify an active policy of rural relief is almost universally acknowledged, and legislation is being enacted to provide an initial amount of twelve million sterling for the purpose. It will also be conceded that the object of such relief should be the bringing about of an effective and permanent improvement in the position of those engaged in the industry.

On a fairly extensive scale relief to primary producers has already been afforded. Such examples as the recent grants in support of the wheat industry, the apple industry, and the financial assistance rendered to the growers of small-fruits are typical cases, while assistance of a more general nature has been afforded by maintaining the exchange rate at its present position and by statutory interest reductions.

The outstanding drawback to all such methods is associated with their blanket-like application. No adequate attempt is made to distinguish between farmers who are in real need of assistance and those who can carry on without help; there is no effective discrimination between efficiency and inefficiency; no effort is made to determine whether the individual farm in question is an economically sound proposition or whether the enterprise is sub-marginal. In fact, the granting of indiscriminate relief is subject to the criticism that it tends to perpetuate the evils associated with inefficient producers and with sub-marginal land which has been opened up in an excess of pioneering zeal and without regard to long-term economic trends. Another grave weakness of such methods is their failure to do anything more than provide financial assistance, whereas it is desirable to combine this with sound guidance on the problems of farm management so that greater efficiency might result.

It is considered that a practicable method of meeting the existing position would be to set up a central controlling authority in each State to administer farm relief. Each central body would in turn be responsible for the establishment and control of district or local representation to consider individual cases. Each local authority should consist of a technically trained agricultural officer who, if necessary, might have associated with him one or more local residents of standing and capable of exercising a sound influence on agricultural matters.

As required, the local authority would conduct an agricultural survey of a farm, determine whether the farming methods were sound, and examine the financial position of the occupier. Where farm and farmer were considered to be more than "sub-marginal," the case would receive attention along the following lines: After conference with the farmer, a programme of work designed to ensure the sound management of the area would be laid down and the probable costs and returns over a number of years would be estimated. After examination of the farmer's financial position, an effort would be made to compound with all the creditors concerned and when satisfactory adjustments resulted, the debts would be liquidated and the enterprise brought under the control of a rural mortgage corporation. In cases where this system of arbitration failed, either debtor or creditor would have the right to appeal to the central State authority. If the creditor proved unreasonable and refused to agree to what was considered a fair settlement, the State authority would have power to issue an interim certificate of individual moratorium. If on the other hand the debtor were regarded as unreasonable, no protection would be afforded and the creditor would be free to take such action as he saw fit. The advantages of a rural mortgage corporation such as is proposed in New Zealand are by no means confined to the borrower who benefits from the lower interest rates. The investor is offered a greater margin of security than is enjoyed under ordinary mortgage conditions, and his asset is easily negotiable. The establishment of such corporations offers a positive means of reducing the interest burden of farmers once their financial position and their farming practices have been put on a sound basis.

There are three apparent drawbacks to any effective system of controlled relief such as have been briefly outlined. The first of these is that any scheme which provided for the granting of relief after consideration of each individual case and would further make provision for supervision of the manner in which such relief should be utilised, would require too elaborate a staff for its administration—it would be top-heavy and costly. Such an objection cannot be permitted to pass unchallenged. Experience gained in Tasmania in connection with agricultural surveys and farm management supervision, under conditions where diversified farming is general, indicates that it is practicable for a qualified and experienced officer to complete 80 farm surveys in a year or to exercise supervision on an equal number of properties which had been previously surveyed and in connection with which the wider aspects of the farming programme had been laid down. Estimating the expenses of a qualified officer at £700 per annum (salary £500, travelling etc., £200) the costs associated with an initial survey are less than £9 per farm, and an equal amount each year would provide for adequate supervision and technical guidance.

The second objection relates to the arbitrary nature of the decisions which would be necessary after consideration of individual cases. It would be difficult, if not impossible, to eliminate completely unfairness and injustice. The human

factor has its limitations and although it should not be difficult to obtain the services of worthy and upright men to adjudicate on each case, errors of judgment would occur. It is questionable, however, whether too much stress should be laid on this difficulty. If relief is to be applied at all, judgment must play its part as it does in every transaction bearing on human relationships, and it is likely that errors and injustices arising from the systematic administration of relief by qualified men specialising in the problem would be fewer than are liable to occur under *laissez faire.*

The third difficulty relates to the dearth of men possessing the necessary training or experience to administer such a scheme and who are capable of guiding and controlling the farming practices of those coming within its ambit. Work of this nature calls for the exercise of sound judgment which can be developed only as the result of a lengthy and diversified experience or by a thorough course of training in farm management. Lack of adequately trained men would make difficult the administration of relief measures based on the principles which have been outlined. Until such time as the position is corrected the difficulty might be overcome by conducting short-term intensive courses for men who have completed their general training, or by associating men of wide practical agricultural experience with the technically trained officers carrying out the work.

The application of rural relief is merely one phase of the inescapable movement towards the exercise of greater control in agriculture, but it has focussed attention upon a rather serious shortcoming in the training provided in our agricultural colleges and universities. It is recognised that there are difficulties associated with any expansion of the courses of study, but for some years it has been apparent that too little stress has been laid upon the business or economic aspect of agriculture and sufficient importance has not been attached to the systematic study of farm management. Attention has been directed to the study of basal sciences and to various phases of agriculture such as animal nutrition, stock breeding, agronomy, etc., treated as somewhat unrelated subjects, but in general there has been no adequate attempt to weld these into a unified mass for their practical application.

Apart from the need arising from the relief measures now under consideration, there are indications that in the future there will be a demand for men qualified to exercise a direct influence on farm management. It is likely that the days of *laissez faire* in connection with the primary industries have gone for ever. We are entering an age when economic planning of national—and possibly even international—scope will be essential. Wide national policies have to be translated into terms of individual farm management, and co-ordinated and guided effort will be required. Quotas, subsidies, bounties and restriction of exports are but the first indications of the advent of controlled production. It is pertinent to ask if we are providing adequate training for the men who will be required to act as the "Staff Corps" for agriculture.

Commerce and Agricultural Research

Abstract of Presidential Address delivered by Mr. G. de V. Davis, B.Sc.Agr., before the Sydney University Agricultural Graduates' Association on February 8, 1935.

The formation in 1931 of the Plant Food Advisory Council of New South Wales was the first organised co-operative effort in that State by which commercial organisations had endeavoured to promote scientific research into agricultural problems. Its formation was the outcome of a meeting between representatives of the fertiliser houses, State Department of Agriculture, the Australian Dairy Council, the Council for Scientific and Industrial Research, and the Fruitgrowers' Federation—and at this meeting the proposal to form a joint experimental body was endorsed enthusiastically.

A vigorous programme of experimental work was at once put in hand, and over the intervening years the policy of the Council was modified so that to-day all new trials conform to the most modern principles with regard to technique. Replicated trials with graduated treatments in series have been and are being laid down on so diverse a range of crops as fruit of all kinds, pastures and fodder crops, sugar-cane, potatoes, tomatoes and field vegetables. In all 111 such trials have been started, of which 87 were carried through or are still in progress.

Based upon the avoidance of errors which prevented the success of its predecessor, there was started in Queensland in 1934 a Pasture Investigation Council which, working through the Department of Agriculture and Stock, is conducting a number of most useful trials on pastures and fodder-crops in the more closely settled dairying centres of that State.

In 1932, under the auspices of the Australian Dairy Council (Victorian Branch) the Victorian Pasture Improvement League was formed. The adherent bodies include, in addition to the founders, the fertiliser companies, machinery and seed organisations, banks, insurance and pastoral finance organisations and the butter factories. These bodies make themselves responsible for the raising of funds which are, under a formal agreement between the League and the Victorian Government, handed over to the Department of Agriculture to defray the cost of a series of pasture experiments. The Department takes the whole responsibility for the laying down and supervision of the trials and for the issue of reports, but agrees to work in co-operation with a technical committee, nominated by the League. In practice, this committee has been able to amend the draft reports, as originally issued.

Eleven major plots were laid down, each consisting of a demonstration of rotational grazing on four one-acre paddocks, a replicated mowing-and-grazing trial on which a series of different fertilisers was tried, and a section devoted to the trial of various varieties and strains of pasture plants and varying methods of establishment.

As with the N.S. Wales work, much general information of confirmatory value has been elicited from this work, but in addition to this, several entirely unsuspected facts have come to light, including a very marked response to lime in a majority of the Gippsland pastures and a number of pastures in the Western Districts in which potash has proved to be the limiting factor to the production of maximum yields. Confirming the findings at Wollongbar and Berry, on the mowing and grazing plots, potash has shown in the Western Districts a cumulative effect, and in the third year of the trials has achieved a much more prominent position on three more of the major plots. The graphing of the results of the periodical cuttings has shown, with respect to nitrogen, in the form of sulphate of ammonia, that the tremendous response to a spring application is followed by a depression in yield so serious that in some cases a pasture so stimulated will produce in the whole year less grass than one not treated and, in consequence, not favoured by so heavy a growth in spring. This discovery suggested an investigation, which is being carried out, of differential applications of this plant-food with the object of determining the optimum season for application.

Apart from the foregoing three bodies, certain fertiliser companies with national organisations are conducting experimental work in other States where, too, the Australian Dairy Council is promoting considerable research, usually in conjunction with the local Department of Agriculture. It is interesting to note that in these States, not only are the results accruing more slowly than in the better organised States, but also the work is not so favourably or so credibly received by the farming community. In spite of that, however, at least two fundamentally valuable points have been elicited by this independent research. One of these has appeared as a preliminary report in the *N.S.W. Agricultural Gazette* (January, 1935) in reference to the effect of fertilisers on the sprouting of potatoes. The other concerns the effect of nitrogen and potash on, respectively, the yield of juice on the one hand and the Beaume and colour of juice of wine grapes. Confirmation of these two points, which is being sought experimentally, would, it is felt, justify the expenditure on private research even without further results which are anticipated.

It is of interest to record that whereas in 1930 there were only two agricultural graduates employed in the fertiliser industry, to-day there are some ten or twelve apart from a number of others employed by various plantations in research, mainly into fertiliser problems.

In regard to future lines of work, whilst the straightout fertiliser problems have been by no means adequately solved, most of the work that remains might be termed of the Vernier type—concerning actual rates and proportions and times of application of the various plant-foods. This, it is felt, had better be left to official organisations with their greater resources in respect of personnel and equipment. The commercial organisations could more than justify their continued existence by concentrating partly on extension work, but mainly by embarking upon a series of economic enquiries.

Scientific Method in the Study of Biology

by

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"Thou seest not all; but piecemeal thou must break,
To separate contemplation, the great whole;
And as the ocean many bays will make
That ask the eye—so here condense thy soul
To more immediate objects, and control
Thy thoughts until thy mind hath got by heart
Its eloquent proportions, and unroll
In mighty graduations, part by part,
The glory which at once upon thee did not dart,
Not by its fault—but thine: Our outward sense
Is but of gradual grasp . . . . . "

—*Byron.*

In its essentials, scientific method is simple and straightforward. It is commonsense of the highest order, but differs from the commonsense of daily life in that it is completely freed from the influence of emotion, and is subject to the rigorous control of observation, experimentation and precise thought. It is not a method which can be applied legitimately only to the study of the higher aspects of the "exact sciences," as some appear to believe, but can be applied to the study of any subject. If an investigator is prepared to be guided wholly by ascertained fact, to take all possible precautions to ensure that the ascertained facts are true, and to draw his conclusions calmly, without emotion or personal prejudice, then his work must necessarily be scientific.

Scientific method cannot be described completely, e.g., by a mathematical formula which, if followed blindly, will inevitably lead to the discovery of truth. Far from being a mere routine, it calls for the use of intelliegnce in the highest degree. Clarity and precision of thought are first essentials, but of equal importance is a faculty for continually reviewing the facts, observations, theories, and hypotheses which are associated with the investigation—in order to find whether they really represent the truth. If they do not, they must be discarded or modified, however distasteful this process may be. Any attempt to force new facts to square with previously conceived ideas is a sure sign of the unscientific mind.

Scientific investigation generally follows a particular course. At the beginning, nothing is known clearly; so extensive observations are made. These serve as the material for subsequent investigation. Such preliminary observations, however, do not give an adequate account of the phenomenon investigated; for, though we may attempt to observe the phenomenon in its entirety, our observation consists essentially of the *selection* and *isolation* of certain of the component

parts of the phenomenon. This process of analysis is of the utmost importance, for it reduces the major problem to a series of lesser problems of manageable proportions.

During this preliminary period of general observation, the investigator will almost inevitably note relations between certain of the observed facts, and he will associate in his mind other known facts with those he observes. In this way hypotheses arise and form the material for future directed investigation. Hypothesis, the result of controlled imagination, is one of the most useful tools of scientific investigation. It directs observation which would otherwise be random in character, and makes experiment possible. Thus, it is highly desirable that an investigator should possess the quality of controlled imagination, for without it he resembles a magpie, merely collecting and hoarding facts. Unfortunately, the ranks of biologists appear to contain large numbers of such magpies, for blind collection of facts has proceeded apace while the co-ordination and synthesis of facts, with a view to reaching an understanding of phenomena, lags far behind.

The second stage of an investigation, then, is the formulation of hypotheses. Actually it is immaterial whether the hypotheses first formed are true or not. Their purpose is to change investigation from haphazard groping for information into directed searching along particular lines. If an hypothesis is wrong, investigation soon demonstrates this, but in the process, new facts are brought to light, new hypotheses are formed, and so the investigation is directed into new channels. Thus, controlled imagination and rigorous collection of facts go hand in hand; imagination indicates where truth is likely to be found, but truth is revealed only when facts have been carefully collected and critically examined.

If unscientifically handled, however, hypotheses are most dangerous things. There is a tendency to develop a certain affection for hypotheses, which is only natural, for they are creatures of one's mind. It is necessary to be utterly ruthless with them: an hypothesis must be abandoned or drastically remodelled as soon as ever one pertinent fact is found with which it is inconsistent.

As already stated, observation reduces the original major problem into a number of component problems of manageable size; observation and experiment aided by hypothesis, lead to the solution of some of these lesser problems. From this stage investigation proceeds in much the same way, but the solution of minor problems permits problems of increased complexity to be handled. By a process of synthesis of the results already obtained, and a continual checking with the observed facts, problems of greater and still greater complexity are investigated, until ultimately the solution of the original major problem is attained.

All this seems very simple, but in practice it is not so simple. Throughout the work, a mental discipline must be maintained which would be intolerable in ordinary daily life. All facts, however completely they appear to have been proved, are subject to review, and the investigator must ever be on the lookout

for flaws in the facts and conclusions he is handling. The investigator is continually arranging and re-arranging his facts and examining them from all possible angles, to make sure that there is nothing he has overlooked and that no error has crept in at any point. This capacity for taking infinite care is the outstanding characteristic of the scientific worker.

At the present time, few of us begin our work faced by a large and ill-defined major problem which must first be resolved into its component parts. Generally we begin where others have left off, and herein lies great danger. The preceding work which forms the basis of our investigation must be critically examined with the greatest care. We must satisfy ourselves from our own work and observations that the facts and conclusions upon which we are about to base our future work, are sound. If by taking other investigators' conclusions for granted we fall into error, we must be prepared to bear the blame, for the only authority recognised by science is fact. Enthusiastic young investigators, in particular, find such careful testing of the work of others most irksome, but it is absolutely essential as a preliminary to sound investigation. Moreover, it is a wholesome discipline for impatiently ambitious research workers.

In scientific investigation, facts and particulars must not be merely enumerated and added together, but must be seen in a new light, if any advance is to be made. Interpretation is thus a very important part of science; but it is surprising how many investigators collect facts with the utmost care, and yet interpret their results casually and often with unbridled imagination. It is necessary to review, check, and re-check conclusions with at least the care that is taken when testing the truth of observed facts. Incidentally, the published results and conclusions of others should be checked critically in this way, in order to see whether the conclusions reached are justified by the published facts and whether the truth of these facts is adequately supported by the observations and experiments upon which they are based. If this were done more generally, many mistakes and half-truths would not have persisted so long in biological literature.

It is impossible to draw a hard and fast distinction between observation and experiment, but the characteristic feature of an experiment is the elimination of the unessential conditions of the phenomenon under investigation. In the most straightforward type of experiment, all conditions are maintained constant except the one under investigation. By varying this condition, its features and properties can thus be studied. This is the usual method followed in the physical sciences, but when studying living organisms it is seldom possible to maintain all but one condition constant. The usual method of overcoming this difficulty is to set up controls in the experiment. These controls are replicates of the true experiments, except that the factor varied in the true experiments is not varied in the controls. The observed differences between the reactions of the organisms

in the true experiments and those of the organisms in the controls are considered to be due to the variable which is being studied. This assumption is dependent upon the behaviour of the uncontrolled variables common to the true experiments and controls. If these do actually vary simultaneously and to the same degree, the assumption is legitimate. Clearly, however, we cannot assume that the common variables must necessarily vary in this way, so experiments of this kind must always be repeated several times. Otherwise we could not be sure that the observed differences in the reactions of the organisms were not due to the uncontrolled and unobserved variation of some factor other than the one under investigation.

It is frequently necessary to analyse the results of biological experiments by statistical methods, in order to test their significance. In fact it is desirable that statistical analysis should be used wherever possible, but here a few words of warning are necessary. Methods which have been evolved to test data of a particular statistical type clearly cannot be used for the analysis of data of other types. There is a tendency for some biologists to take well-known formulæ and to apply them to their problems, without first making sure that their data are of the type for which the formulæ were evolved. Such unintelligent use of statistical formulæ must inevitably lead to disaster. It must also be realised that even the most elaborate statistical treatment will not atone for careless collection of data, or for poorly designed experiments.

Scientific method demands that the utmost care be taken at every stage in an investigation: each forward step must be made on the firm ground of established fact.

Plant Quarantine

Abstracts of papers presented at the discussion on "Plant Quarantine" at the Agricultural and Forestry Section of the A. and N.Z.A.A.S. Congress in Melbourne on January 22, 1935.

Dr. R. J. NOBLE, Biologist, Dept. of Agriculture, Sydney, N.S.W., in opening the discussion, said that the economic value of successful quarantine was readily apparent, for it was obvious that direct losses were avoided, costs of remedial treatments were obviated, and the plant breeder was not called upon to add another problem to his already overburdened programme.

The development of an adequate and satisfactory series of measures to achieve this object was by no means easy. The problems were complex, and it was felt that all technical plant specialists should realise their individual and collective responsibilities in this connection; the questions should receive far more detailed consideration than had been the case in the past, and means should be devised to provide adequate technical opinion for the formulation of a satisfactory

solution for Australian conditions. He had expressed somewhat similar views in 1924 (*Agric. Gaz. N.S.W.* 35: 883-888, 1924), and it was regretted that a national trade crisis only was responsible for calling into temporary existence an advisory body for consideration of certain specific questions in this connection.

Quarantine restrictions had protected us in the past, but they could not be expected to produce miraculous results. Measures formulated after careful consideration might, however, be expected to delay, perhaps indefinitely, the introduction of serious diseases, and, at the same time, such measures would be accepted by the technical advisers of other countries as bona fide, thus averting the dangers of serious repercussions in trade relationships.

These matters were also the concern of all members of the community, and their co-operation was most desirable. A realisation of responsibility by members of the community had been of definite value in local quarantines, and a similar sense of responsibility was essential in respect of overseas quarantines. Intelligent co-operation would do much to reduce risks which could not otherwise be avoided. Machinery was not available for complete enforcement of regulations, and, in order to effect complete protection, regulations might have to be so drastic that they would have the most serious effects on most forms of international trade.

The plant specialist, in contrast to the medical man and the veterinarian, was concerned with an enormous number of hosts and their associated diseases throughout the world. American authorities had compiled records of several hundred thousand diseases which were known to attack plants in various parts of the world. Relatively little information was available concerning the plant disease situation in the various States of the Commonwealth. There were some 1260 diseases recorded in New South Wales, and there was evidence that some of these diseases were relatively recent introductions.

During 1934 there were 38 additions to the list of N.S.W. plant diseases, and since 1930 there have been 15 new records of vegetable diseases, some of which—notably Bacterial Canker and Cladosporium Leaf Mould of tomatoes—already have seriously affected production.

At the same time, there should be relaxation of existing restrictions whenever the facts justify reconsideration of the position.

It is desirable, also, that plans should be prepared in advance to meet an emergency such as may result from the establishment of a new and possibly serious plant disease. The plant specialists throughout the Commonwealth should accept their responsibility in this connection. Suitable plans for necessary action should be prepared in advance, and these plans should be subject to constant revision as new facts become available. All action must be based on the best available professional opinion, and the problems should be considered from the national standpoint.

"Let us hope that there will not be any parochial interpretation of Section 92 of the Constitution, and, in fact, insofar as it touches on questions of plant disease, that the interpretation will be similar to that applied to the comparable section of the United States Constitution (*Phytopath* 19: 489-490, 1929)" Dr. Noble added.

"While we believe that the principles which have been found generally acceptable for action in Australia in the past, have been sound, we should endorse those which were promulgated by the National Plant Board of the United States in 1931 (*Phytopath* 22: 933-935, 1932) and which were formulated after years of intensive consideration by specialists in that country. Their concise and comprehensive statement might well be accepted for guidance of all interested in such matters throughout the world.

"Let us reaffirm and implement the resolutions that we have carried on various occasions in the past, and may we build even more soundly for the future."

Mr. S. FISH, Biologist, Dept. of Agriculture, Victoria, said: There are many factors which need careful consideration before quarantine measures are promulgated. The economic effect of any proposed measures must be considered. The quarantine costs and possible trade restriction from other countries as against the cost of any control measures, if they are available, and the possibility of outside quarantines as the result of the new introduction, are all points which present great difficulties. The chances of possible repercussions on trade from plant quarantine action is bound up with the soundness or otherwise of the scientific basis on which quarantine measures are based. It is obvious that quarantine measures, even though resting on a sound scientific basis, may incidentally result in the protection of certain primary industries, and thus appear to support the occasional suggestion of the illegitimate use of plant quarantine. Quarantines which are not sound will quickly produce trade complications, and will also shatter public confidence even in vital quarantine measures. The practicability, both from the administrative and legal standpoints, of adopting the precautions dictated by the scientific considerations of the pest or disease, constitutes the main administrative problem of plant quarantine.

The methods available for the application of plant quarantine principles to practice consist of the inspection of plants and plant parts at the points of origin and entry, the total embargo method, and controlled introduction. Recent advances in biological knowledge have, in some cases, made possible the modification of the total embargo method; moreover, the trade reactions due to embargoes have demonstrated the urgent need for modified methods where possible. Total prohibition should be confined to what, after a thorough examination of the facts, are classed as possible major diseases or pests, and then

only when the principal avenues by which they could be introduced cannot be eliminated. The general scientific recognition of such a fact would be the justification for the action. In systems of quarantine merely based on inspection, either at the point of origin or the point of destination, or both, it has been shown that it is not possible to prevent the introduction of pests and diseases by such methods.

The present trend of plant quarantine is definitely in the direction of controlled introduction of plants and plant parts. Such a method, in many cases, is capable of giving the desired protection without restraint of trade. Under this system, plant material is introduced if certified by competent authorities that it has originated in a clean area or that it has been treated by a satisfactory method of sterilisation. The soundness of this method depends on the existence of exact data as to the geographical distribution of plant diseases and pests in question; hence the necessity for the extension of this survey work and its publication. With the aid of a properly equipped and efficiently organised quarantine station it is felt that the introduction of small quantities of plant material for propagating purposes could be effectively handled.

The recent lessons which Australia has had of the introduction of new and serious seed-borne diseases have demonstrated the urgent necessity for the extension of the method of controlled introduction based on sound biological information, and it is by such lessons that an efficient quarantine practice is evolved.

Mr. E. MEEKING, Chief Plant Quarantine Officer, Victoria, said: Plant quarantine in Victoria was first established under the original Vegetation Diseases Act in 1896. In 1908, the Commonwealth Parliament passed the Quarantine Act which came into force in July, 1909. The State's power to control plant imports from overseas was then superseded, and the Commonwealth assumed the responsibility of protecting Australia as a whole against the introduction of diseases affecting man, animals and plants. Both the Act and the Regulations have been strengthened by amendments from time to time; but, beyond this, there is little evidence that any serious attempt has been made to organise and develop plant quarantine procedure on lines deemed both possible and desirable, and for which the legislation should merely provide a basis.

The Act provided for the appointment of a Director-General, a Chief Quarantine Officer in each State, and as many quarantine officers as necessary. Since the inception of the Act, officers of the State Department of Agriculture have carried out the inspectorial work in conjunction with similar duties for the State. The Commonwealth recoups the State for this. In 1926, the Commonwealth Director of Plant Quarantine was appointed.

From what has been outlined concerning the extent and scope of operations in quarantine in Victoria, it would seem that a satisfactory system of plant

quarantine has been established; but speaking as one in close and constant association with its activities, one feels that after 25 years existence, it has developed little beyond the swaddling clothes stage. It is felt that this important section of plant hygiene has not received the co-ordinated and systematic attention its importance demands.

It is believed that this Cinderella condition arises largely through dual control, whereunder the Commonwealth administers the legislation and the State carries out the associated activities. Apart from other aspects, it is considered that this dual control creates an apathy towards granting the necessary funds for proper development of plant quarantine activities.

The following may be mentioned as some of the evident disabilities: Lack of uniformity both in the procedure and equipment existing at all ports; no facilities are available to admit under quarantine precautions, in lieu of existing prohibitions, certain kinds or varieties of plants required for genetic or economic purposes; the technique of plant quarantine performance in connection with the importation of seeds is faulty; no separate intelligence service has been established for the information of officers with respect to foreign and local incidence of disease; no curriculum and syllabus have been drawn up to ensure a uniform standard of qualification for plant quarantine officers; and finally, the public has not been sufficiently educated in its responsibility of assisting authority to prevent the spread of weed seeds, plant diseases and insect pests.

The suggestions offered for the improvement of plant quarantine procedure imply considerable additional expenditure, but the introduction of European corn borer, citrus canker or fire blight—to mention only a few of the serious foreign diseases and pests—would result in losses which would exceed the sum of administrative expenditure over many years.

PROFESSOR K. H. BAILEY, Professor of Public Law in the University of Melbourne, Vic., said: I suppose there is general agreement that plant quarantine—local, interstate, and international—is a real necessity of civilised life. But we must face the fact that the politician, and behind him the plant expert, is widely suspected of yielding to the pressure of local trade interests, and devising systems of regulation which, on the face of them, are based on scientific grounds, but are really mere camouflage for the old State-protection idea, which Federation was intended to supersede. There is room for the frankest kind of scrutiny of policy in the light of that feeling.

From the viewpoint of an Australian constitutional lawyer, the question is: What Government may take the action necessary to make quarantine effective, and how can we ensure that such action will be taken on purely scientific grounds ?

Apart from Section 92 of the Commonwealth Constitution, the position would be clear enough. The Commonwealth Parliament has full power to make quarantine laws, whether local or interstate or international. So also have the States, so long as the Commonwealth Parliament does not over-ride them. But s. 92 declares that "trade, commerce and intercourse among the States shall be *absolutely free.*" "Free" is the most elusive adjective in the language: you cannot tell its meaning till you know what the subject has to be free *from*—and that is precisely what the Constitution does not say. Please don't blame the lawyers for that: it was laymen who insisted on retaining that gloriously ambiguous phrase, "absolutely free."

How much quarantine power, then, may States exercise and still leave trade "absolutely free"? The High Court has said—remarkably enough, it may seem —that so long as a State is genuinely making a quarantine law to prevent the entry of disease, the State may exercise all the quarantine powers that it could before Federation, and still leave interstate trade "free," in the relevant sense. It may exercise even the power of absolute prohibition of imports from another State in which disease is prevalent. This decision was given in 1928, in a New South Wales case concerning the import of cattle from tick-infested areas of Queensland. Recently the High Court heard a complaint against the Victorian embargo on Tasmanian potatoes. This case has not yet been decided; it is by no means certain that the earlier decision will be upheld.

The embargo power is clearly the one in which ideas of State-protection can most easily lie concealed. If—as Mr. Fish suggested—the embargo be still necessary in some cases in view of the existing state of biological knowledge, it would be wiser to have it vested in the hands of the Commonwealth alone, leaving to the States the power of control by means of inspection laws. Even there, as departmental witnesses frankly told the Royal Commission on the Constitution in 1928, State-protection may creep in.

The urgent need seems to me to be to devise some institution for dealing with these essentially scientific questions on a non-political basis. I gravely doubt whether Australia can be freed from the use of State quarantine powers for trade protective purposes, unless we are prepared to set up again some form of interstate commission with power to review, and possibly even to annul, State legislation. In the long run, I do not myself think that quarantine is a problem that can be dealt with effectively except on a uniform—and national—basis; but if State authority is to continue even approximately as at present, I think that further safeguards are necessary.

TECHNICAL NOTES

RESPONSE OF ENGLISH AND AUSTRALIAN WHEATS TO LENGTH OF DAY AND TEMPERATURE.

In order fully to understand plant behaviour, it is necessary to recognise that development proceeds along two separate lines, "growth" and "reproduction," and that the conditions which control each are quite distinct. Research workers have defined with more or less certainty the conditions favoring "growth," but development along the reproductive side through the various vegetative and flowering stages has not received the same attention, and our knowledge of the factors controlling it is very meagre.

The importance of "length of day" on the flowering of plants was first emphasised by Garner and Allard in 1920 (1). Subsequent work has shown that temperature also plays an important part, and in its turn may either hasten or retard reproductive development. With a view to gaining information on the effect of the interaction of these two factors on wheat development, experiments were conducted by Mr. A. J. Vasey and the writer at the State Research Farm, Werribee, and the results are briefly reviewed in the following paragraphs.

The initial experiments (2) in 1929 dealt with length of day alone, and showed that English and Australian wheats differed materially in their response to this factor, the Australian varieties responding to a greater degree to a shorter day length than English wheats.

Subsequently trials were designed to test the combined effect of both length of day and temperature. Observations were made on the dates of development of three varieties of wheat—"Free Gallipoli" (an Australian spring wheat), "Red Marvel" (an English spring type) and "Little Joss" (an English winter wheat). These were sown at 7-10 day intervals throughout the year in two sections: (a) under normal daylight, (b) under a constant 16-hour day.

The results of the autumn sowings showed that those plants receiving the longer day headed approximately 38 days earlier than the normal plants. As the length of day increased with the approach of summer, the difference between the two sections decreased. Temperature also played a large part in hastening development; the plants sown during the summer headed 60 days earlier than the winter sown wheat. A remarkable feature was shown by the Little Joss seedlings,—the plants after the September sowings remaining in the rosette stage right through the summer and only heading during the next spring. This

feature was not shown by the two spring wheats—Free Gallipoli and Red Marvel—but an intermediate stage, shown also by Little Joss, was noticed in the January and February seedings when two series of heads were produced on the one plant.

In interpreting the results it was evident that temperature alone affected the number of days for germination and for the period from heading to the ripening of the grain. The rosette and jointing stages, however, were affected by both temperature and length of day. The observations also showed that soil temperatures above 15°C. prevented development of the winter wheat beyond the rosette stage, while temperature of 30°C. did not limit development of the spring types. These latter plants, however, showed abnormal features, and it is possible that slightly higher temperatures would have arrested development.

From the point of view of economic importance, the results have demonstrated the possibility of growing two and sometimes three successive generations of plants in one year. This has been of great value to plant breeders in reducing the time necessary for breeding new crossbred wheats.

The results have also indicated that wheat varieties, although "fixed" with regard to maturity when grown under normal conditions, show marked variation when sown under different length of day and temperature conditions. This affords a ready explanation of the manner in which new strains may arise by natural selection when wheat seed is transported from one country to another.

The results support much of the evidence produced recently by the various Russian workers (3). It is evident that soil temperatures are often sufficiently high to prevent development beyond the rosette stage in winter wheats, unless the germinated seed has been previously subjected to a period of low temperature. An examination of the development of the spring wheats, however, showed that our normal soil temperatures, even in summer, did not have the same inhibiting effect as that which occurred with the winter wheats, and it was possible therefore to forecast that the Russian "Jarovisation" treatment would not have any appreciable effect on our Australian wheats, which are all of the spring type. Further experiments (4) which were carried out last year fully confirmed this conclusion.

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(1) Garner W.W., and Allard H.A. (1920). *J.Agr.Res.* 18: 553-606.
(2) Forster, Tincker, Vasey & Wadham (1932). *Ann.App.Biol.* 19: 378-412.
(3) Lyssenko T. D. (1932—*Bull.Yarovitzatzii* No. 1, 14-29
(4) Raw A. R. (1934)—*Proc.Roy.Soc.Vict.* 46: 131-138

EPIMEGASTIGMUS BREVIVALVUS GIRAULT, A PARASITE OF THE CITRUS GALL WASP, *EURYTOMA FELLIS* GIRAULT.

During a recent study of the life history of a wasp, *Eurytoma fellis,* which causes galls on citrus in northern New South Wales, it was found that the most abundant parasite was a *Torymid, Epimegastigmus brevivalvus,* which proved to have an unusual life history.

In the spring, the female of *E. brevivalvus* deposits her eggs within the eggs of *E. fellis* which had previously been deposited between the bark and the wood of spring growth citrus. It is not, however, a true egg parasite as its larval life is not passed within the host egg.

The incubation period of the egg of *E. brevivalvus* is several weeks longer than that of the host, and the latter, though parasitised, hatches in a normal manner, and for a time the parasite is present as an egg, lying freely in the hæmocœle of the young host larva.

A few weeks later, the parasite larva hatches, but it remains as a minute first stage larva for a period of nine months. During the greater part of this time the host larva, being not apparently seriously affected by the presence of the parasite, grows steadily, and early in the subsequent spring it reaches maturity.

At this time, the small parasite larva commences to feed voraciously, increases in size rapidly and finally, before the host larva can pupate, devours the whole of its internal body contents, and for a few days lies ensheathed in the last larval skin of the host. It then eats its way out of this skin, and later pupates in the cell in the gall previously occupied by the host. A few weeks later the adult parasite emerges and eats its way out of the gall, the emergence of the parasite commencing a few days before the last host adult emerges.

The majority of the members of the genus *Megastigmus,* of which *Epimegastigmus* is a subgenus, have been found to be phytophagous, usually feeding within the seeds of various trees, and the present instance appears to be one of the few records of parasitism in the genus.

The habit of a parasite ovipositing in the host egg, while the parasite larva develops within the host larva, has in recent years been found to occur in a number of species belonging to the families *Encyrtidae, Eulophidae, Proctotrypidae, Cynipidae* and *Braconidae.* To this list, as a result of recent observations by the writer, must be added the family *Torymidae.*

N. S. Noble.

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RELATION OF PASTURE DEVELOPMENT TO ENVIRONMENTAL FACTORS IN SOUTH AUSTRALIA

The basic concept in all grassland studies should be an ecological one. The many various types of pasture are closely dependent on the immediate climatic, edaphic and biotic factors of the environment and may be related to the kind of vegetation which has naturally developed to a comparatively stable or climax condition with the passage of time.

To facilitate the study of pastures on a State-wide basis, in South Australia, a map has been prepared on which the actual grazing areas are depicted by the combined dot distributions of sheep, cattle and horses, plotted in relation to the major forms of climax vegetation. The latter are taken as a composite reflex of the natural environment.

Agronomic investigations relating to pasture improvement have been confined to the comparatively limited areas of natural forest and savannah woodland. The indigenous grasslands here tend to be dominated by *Danthonia* spp. with *Microlaena—Eragrostis* co-dominant in the areas of most extended winter rainfall, and *Stipa* spp. co-dominant to dominant as the Mallee type of environment is approached.

Danthonia pastures have developed chiefly on soils deficient in available phosphate and frequently low in available nitrogen as well. The application of superphosphate to these pastures improves sheep-carrying capacity and wool production per acre, but frequently results in an annual pasture dominated by species of a decidedly inferior nature.

The productivity of natural pastures is limited primarily by low general fertility and indifferent botanical composition, but is also closely dependent on autumn rainfall, in contradistinction to spring rains in the case of cereal crops. The failure of the natural pastures to take advantage of the spring rains is a serious disability and lowers their potentialities for production in early summer, under South Australian conditions. It is probable that seeded pastures based on species and strains with an extended growth period are much better able to utilise rains which occur in the latter half of the year.

Leguminous plants appear to be essential as a basis for pasture improvement in South Australia. This is because the soils of the higher rainfall areas either are deficient in total nitrogen or tend to become deficient in available nitrogen in the absence of cultivation or a suitable pasture legume. The legumes of established value for perennial pastures are white clover, strawberry clover, Mount Barker and Dwalganup subterranean clover and lucerne. The necessity

for permanent associate grasses is now very obvious. The grasses of proven value are perennial rye-grass and cocksfoot, *Phalaris tuberosa, Poa pratensis* and Wimmera rye-grass.

The area of artificially seeded pasture in South Australia has risen from only 22,278 acres in 1922-23 to 208,418 acres in 1932-33. Of this total, subterranean clover pastures account for 142,317 acres, lucerne 49,637 acres and other types 16,464.

The distribution of subterranean clover is sharply defined and coincides closely with that of blue gum savannah (*E. leucoxylon*), red gum and sclerophyll forest. The mean annual rainfall of these areas is 20 inches or more, and rainfall usually exceeds evaporation for five months of the year. Lucerne is less dependent on immediate climatic influences and more dependent on subsoil moisture reserves. White clover and strawberry clover are grown only under irrigation and in the humid areas of the extreme south-eastern corner of the State. The extension of seeded legumes into lower rainfall areas depends largely on the use of earlier maturing varieties of subterranean clover.

Superphosphate has so far proved to be the only suitable fertiliser for economic use on pastures in South Australia, nitrogen deficiencies being overcome by the use of legumes. The response of subterranean clover to superphosphate follows very closely the calculated Mitscherlich curve. Under favourable soil and climatic conditions, the optimum economic dressing in the year of establishment appears to be 2 cwt. per acre. Where a light seeding of an associate permanent grass is added to the initial seeding of clover, a small dressing of ½ cwt. sulphate of ammonia has significantly improved the establishment of both constituents of the pasture.

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WITCHES' BROOM—A NEW VIRUS DISEASE OF LUCERNE.

Witches' broom is a disease of lucerne characterised by marked dwarfing of the plant and a considerable increase in the number of shoots produced from the crown. The stems become very fine, the leaves are considerably reduced in size, and the foliage commonly presents an erect, bunched appearance. In badly diseased plants a thick, dense mass of shoots may be produced which may not exceed six to eight inches in height. The leaves become more rounded than normal and frequently show marginal chlorosis together with puckering and distortion of the lamina. The majority of the affected plants fail to flower, but

occasionally very small blooms are produced which are much paler in colour than the normal flowers. Seed is rarely produced. Phyllody has been observed on a number of occasions. Extensive rotting of the crown and root tissues is commonly associated with the later stages of the disease, and is frequently responsible for the premature death of affected plants.

The witches' broom disease is prevalent throughout the inland areas of New South Wales where extensive areas of lucerne have been established for grazing purposes. Field infection of 20-25% is of common occurrence, whilst in isolated cases old stands have been observed in which 60-70% of the plants have shown advanced symptoms of the condition. The disease does not occur in crops less than fifteen to eighteen months old, but in older stands in inland areas it is invariably present and becomes progressively worse as the crop ages. A carefully planned yield experiment has shown that over a period of two years, under normal field conditions, the diseased plants have yielded at each cutting an average of 37.4% less weight of green fodder than that obtained from the unaffected plants. The witches' broom disease has been known to growers for 25-30 years, and is commonly called "Spindle Shoot," "Mistletoe," "Bunchy Top" or "Kurrajong."

It is only during recent years, coincident with the rapid extension of lucerne growing in the hotter, drier areas, that the disease has been regarded as a serious problem. Investigations of the disease commenced in 1931, and, as repeated isolations had failed to associate any organism with the condition, and as the symptoms were strongly suggestive of virus infection, the investigational work has principally been concerned with transmission experiments.

Positive transmission of the disease has recently been effected by grafting, the diseased scions being introduced into the healthy stocks by means of the side or veneer graft. It has not been possible to transmit the disease by means of mechanical inoculation, and transmission experiments with massed populations of possible insect vectors have likewise failed to establish infection. A seed transmission experiment with a limited quantity of seed obtained from infected plants, has also failed to give positive results. It is considered highly probable that an insect vector is concerned with the transmission of the disease under natural field conditions, and additional investigational work concerning this aspect of the problem is now in progress.

A full account of the witches' broom disease and the investigational work will shortly be published as a Science Bulletin of the N.S.W. Department of Agriculture.

E. T. Edwards

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MINERAL NUTRITION IN VICTORIAN FRUIT TREES.

The problems associated with the use of artificial fertilisers on orchard trees have proved far more complicated than was originally anticipated; and, until quite recent years, no material advance was made during almost half a century of field experimentation, covering a wide range of fruits in many countries.

The conception has arisen during the past decade, mainly as a result of sand culture experiments, that fertilisers should be applied, if necessary, to maintain tree health and normal yield, rather than to directly increase yield of healthy trees.

Sand culture experiments similar to those designed at Long Ashton, England, have been conducted in Victoria to determine the symptoms associated with a deficiency of calcium, magnesium, potassium, nitrogen and phosphorus—the more commonly used fertiliser elements. At the Burnley Gardens, Melbourne, Jonathan apple trees have been grown for several seasons in pure quartz sand, and watered with nutrient solutions. The growth of control trees watered with a complete solution has been compared with several series in which, respectively, each of the elements has been in turn omitted from the nutrient solution.

From the outset of the experiment, characteristic differences have been noticeable, of which the following are brief examples :

Nitrogen deficiency has produced very restricted growth, small yellow-green leaves, reddish-colored bark, delayed bud-burst, early defoliation, with light yellow tints in the leaves prior to falling. Defoliation has commenced from the base of the tree, and proceeded upwards.

Phosphorus deficiency has produced restricted growth, small narrow bronze leaves often with reddish margins, reddish bark, very much delayed bud-burst, and very early defoliation, resembling in appearance that of nitrogen deficiency.

Potassium omission has resulted in somewhat restricted growth, leaves of dull green color often developing a marginal scorching and curling. Defoliation, when early, commenced at the tips of shoots rather than at the base of the tree as in phosphorus and nitrogen omissions.

Calcium omission produced somewhat restricted and often whippy growth. The leaves tended to fold up in the manner of a butterfly's wings, and to be abnormally hairy on the under surface. They were prone to fungal spotting and irregular brown blotching. In some cases, prior to defoliation, the whole of the leaves of occasional limbs turned definitely reddish purple.

Magnesium deficiency, in these as well as in experiments reported from overseas, has given slightly increased growth and leaf size. The leaves tended

to develop a chlorotic patch at their centres, which, later, turned brown and dry. On defoliation, vivid autumn tints were often produced.

Further experiment has shown that trees exhibiting acute symptoms of deficiency return to normal rapidly, when given a complete nutrient treatment, —leaf size and color being the first characters to respond.

Chemical analyses of whole plants support the idea that the balance between the minerals is of greater importance than the actual amounts present; and that a deficiency of one may increase the absorption of the remainder,—thus throwing the balance even further from normal.

The results of the experiments are already of diagnostic value in the field.

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STANDARD LABORATORY COLONIES OF *EUTERMES EXITIOSUS* HILL FOR TIMBER TESTING UNDER CONTROLLED CONDITIONS.

The applied side of termite research has long been handicapped by the lack of a satisfactory method for testing timbers and timber treatments for resistance to termite attack. A method of testing with standard laboratory colonies of *Eutermes exitiosus* Hill has now been developed. The species used is one of the most important economic species in the Commonwealth (1). It is a mound builder (2) which runs its galleries through the soil to attack timber in the vicinity. Its colonies are very populous (3) and the mounds always contain a large number of individuals, which can be secured for experimental purposes. It is possible to separate a quarter of a million termites from a mound in a few hours, weigh out amounts to give populations of 5,000 workers and re-establish these sub-colonies in jars; there is a negligible mortality of handling and an average variation from the population expected of plus or minus 1½%.

A population without any means of increase will decrease in strength through natural mortality. The aim of the investigation has been to study the factors likely to affect the life of the termites in jars or the standard nature of the colonies, and to regulate these factors so that the mortality will be a minimum and the colonies as uniform as possible. The following factors or conditions have been studied:

1. The method of handling the termites and the general procedure in setting up colonies.

2. The nest material.
   (a) The particular portion of the mound to be used in the jar colonies.
   (b) The size of the individual pieces of nest material.
   (c) The amount of nest material.

3. Other factors: Temperature, humidity, moisture content of mound material, proportion of the different castes, number of termites, ventilation of the colonies.

These factors have now been standardised at a satisfactory level. Colonies with an initial population of 5,000, plus soldiers equal in number to 10-15% of the total, can now be kept in captivity so that at the end of three months 70% of the initial population remains alive as active healthy termites; the variation in survival and the variation in amount of wood consumed are both in the vicinity of plus or minus 2%.

The wood used as food in the colonies has been a susceptible wood, *Eucalyptus regnans* (Mountain Ash). Although the pieces were from a single board of "true wood," there has been considerable variation in the amount of attack on different pieces. It has therefore been necessary to devise a method of testing in which a single species of wood was used in each colony and the attack on the wood measured in terms of the total amount of wood consumed, rather than the attack on individual samples. With a resistant wood, the wood is not eaten but the population gradually decreases as a result of cannibalism. Susceptibility to attack is proportional to the magnitude of the population surviving at the end of a given time, i.e., resistance is inversely proportional to the population surviving. The total amount of wood eaten by a standard colony is also a measure of the susceptibility or resistance of a wood.

The standard laboratory colonies as now developed are thus standard eating machines which constitute a biological measuring stick of resistance to termite attack of any material submitted to test.

An account of the developmental work and the method of testing will be published in detail in a publication of the C.S.I.R.

F. G. Holdaway

Canberra, F.C.T.

Council for Scientific and Industrial Research,

(1) Hill, G. F. Australian termites (Isoptera). Biological notes and descriptions of new species. *Proc.Roy.Soc.Vic.* 44: 134-154, 1932
(2) Holdaway, F. G. The composition of different regions of mounds of *Eutermes exitiosus* Hill. *Jour.Counc.Sc.andInd.Res.* 6 (3): 160-165, 1933.
(3) Holdaway, F. G., Gay, F. J., and Greaves, T. The termite population of a mound colony of *Eutermes exitiosus* Hill. *Jour.Counc.Sc. and Ind.Res.* 8 (1): 42-46, 1935

HELMINTHOSPORIUM ROOT-ROT OF CEREALS

In the course of the writer's studies on cereal root-rot diseases in New South Wales, three species of the fungus *Helminthosporium* have been isolated from affected plants,—*H. sativum,* P.K.B., *H. tetramera* McKinney and another species which appears to be identical with that designated *Helminthosporium M* by Henry (2). Boedijn (1) has studied the small-spored species of the genus, and has established the new genus *Curvularia* which includes several fungi previously classified as *Acrothecium, Brachycladium, Brachysporium, Helminthosporium, Napicladium* and *Spondylocladium.* According to Boedijn's classification the species designated *Helminthosporium M* by Henry and the writer, is *Curvularia ramosa* (Bainier) Boedijn.

Studies of several isolates of each of the three species in respect of cultural characters on agar, rate of growth on agar, and pathogenicity on wheat, oats, barley and rye, have demonstrated the existence of numerous strains in each fungus. It was also observed that different isolates of the one physiologic form exhibited wide differences in respect of colony diameter under the one agar treatment.

The pathogenicity tests of cultures of each species showed that *H. tetramera* was only weakly parasitic; also that *Helminthosporium M* was more virulent than *H. sativum,* although the severity of infection with different isolates varied considerably in each of these two species. Tests with 54 isolates of *H. sativum* showed that most of them were of negligible pathogenic importance when tested on seedlings under glasshouse conditions, using sterilised soil. This is in agreement with the results published last year by Sanford and Broadfoot (3), but is in disagreement with the conclusions reached by earlier workers in this field of study. The question is being still further investigated.

In *Helminthosporium M* and *H. sativum* it was apparent that certain isolates which—according to six different cultural treatments on agar—were of the one physiologic form, exhibited wide differences in pathogenicity on all four cereals. It was quite evident that the infection capabilities of a mass collection of cultures could not be predicted from behaviour on agar media.

A Science Bulletin of the N.S.W. Dept. of Agriculture, dealing with studies on *Helminthosporium* root-rot of cereals, is now in press.

H. J. Hynes.

Dept. of Agriculture,
Sydney, N.S.W.

(1) Boedijn, K B. *Bull. du Jardin Botanique de Buitenzorg,* Serie 3, Vol. 13, Livr. 1, 1933
(2) Henry, A. W. *Univ. Minn. Agric. Exper. Sta. Tech. Bull.* 22, 1924
(3) Sanford, G. B. and W. C. Broadfoot. *Canad. Jour. Res.* 10: 264-274, 1934

The Australian Institute of Agricultural Science

SOME POINTS FROM THE CONSTITUTION

QUALIFICATIONS FOR MEMBERSHIP

Members shall be of three classes—Corporate, Student, and Honorary. A Corporate member shall be either:

(1) A graduate in agricultural science from an Australian university or from an overseas university of a standing acceptable to the Council of the Institute, or

(2) A professor or full-time lecturer on the staff of the School of Agriculture or Faculty of Agriculture of an Australian university, or

(3) A graduate of an approved university who, not being a graduate in agricultural science, shall have been primarily engaged for at least two years in agricultural research, administration, education, extension work, or any other form of allied work deemed acceptable by the Council, or

(4) A non-graduate who is engaged primarily in agricultural research or administration or any other work deemed acceptable by the Council, and who shall have been so engaged for a period of five years at the time of his application for enrolment, and who shall have been nominated by not less than six Corporate members (under Clauses 1, 2, and 3 above) of any local branch, recommended for membership by a two-thirds majority of the committee of that branch, and then be elected by a two-thirds majority vote of the Federal Council. It is expressly understood and hereby confirmed that the whole of this Clause (4) shall be automatically deleted immediately after the expiration of three years from the date of the inaugural meeting, and the only persons then eligible for Corporate membership will be those provided for in Clauses 1, 2, and 3 above.

Student members shall be students in their second or any subsequent year of a degree course at an approved university. Honorary members shall be persons who have rendered eminent service to agriculture, or to the profession in general or to this Institute in particular.

Except as provided in Clause 4 above, Corporate and Student members residing within the area of a local branch shall be elected to membership of the Institute by the branch.

LOCAL BRANCHES

The society, association, institute or other organisation of graduates of the Faculty of Agriculture in the University of any State or Territory of the Commonwealth of Australia, or any group of eligible persons in any State or Territory, may constitute a local branch of the Institute, provided, amongst other things, that such organisation or group has a Constitution compatible with that of the Institute. Each local branch retains complete autonomy regarding the conduct of its own affairs within the area of its jurisdiction, and also retains the right to accept as members persons not eligible for membership of the Institute, or being eligible, not agreeing to become members.

FEES

The annual subscription for Corporate members is £1/1/-, for Student members 5/-.

JOURNAL

The journal shall be sent free to the registered address of each Corporate, Student and Honorary Member of the Institute. Each local branch, other than that of which the Editor is a member, shall appoint a Sub-Editor, whose duty it shall be to receive and review literary matter for publication from the members of the local branch, and to arrange for the selection of technical articles by competent local authorities.

GENERAL MEETINGS

The general meetings of the Institute shall be held in conjunction with meetings of the A. and N.Z.A.A.S. held in Australia, or at such other times and places as the Council may from time to time determine.

MANAGEMENT

The Institute shall be governed by a Federal Council consisting of the President, one Vice-President from each local branch, the Hon. Treasurer, the Hon. Secretary, the Editor of Journal and a Federal Committee consisting of delegates from each local branch —one from each branch having 25 or fewer financial Corporate members of the Institute, two from each branch having 26-50 such members, three for 51-75 members, and four for 76 or more such members.

The Executive Committee shall consist of the President (or his proxy), Treasurer, Secretary, Business Manager of Journal, and four Corporate members resident in the State of the Office of Management. This Committee shall have power to act for the Council in all matters of routine.

EXECUTIVE COMMITTEE MEETING

Mr. A. J. Vasey, Hon. Secretary of the Institute, in a letter dated February 11, states that for the time being it is intended to hold monthly meetings of the Executive Committee on the occasions of the visits to Melbourne of the President, Dr. A. E. V. Richardson.

The second of these meetings was held on February 28, and the main item of business was to consider the solicitor's report on the Memorandum and Articles of Association as approved at the meeting of delegates on January 17. The request for official recognition of S.U.A.G.A. as the N. S. W. branch of the Institute was granted on the motion of Mr. F. M. Read, seconded by Mr. J. Brake.

The Institute will function mainly through its local branches, and Mr. Vasey wishes it to be known that any communications on matters of organisation, registrations, etc., from various centres will be dealt with as expeditiously as possible.

The fact that agricultural scientific societies have been in existence in several of the States for some years, means that local branches of the Institute should be quite readily formed in the near future.

The Agricultural Sciences Club, S.A.

CORRESPONDENT : MR. H. C. TRUMBLE

No meetings of the Agricultural Sciences Club of the Waite Research Institute are held during the December-February period. In January, a large contingent—approximately half the University and C.S.I.R. staff stationed at the "Waite"—visited Melbourne for the Science Congress and to attend the inaugural meeting of the Australian Institute of Agricultural Science.

The proposed formation of the local branch of the new Federal Institute and the relation of the Agricultural Sciences Club to the local branch and to the new Institute, have provided much food for thought and discussion. A count of heads and inquiries as to future intentions have revealed that there are likely to be at least 30 certain foundation members in South Australia, with 6 further probables and about 2 members of the "Waite" staff uncertain or unlikely. It has been suggested that four meetings of the local branch should be held each year at bi-monthly intervals, with the five bi-monthly meetings of the Sciences Club alternating with those of the local branch. The Club meetings would be devoted chiefly to scientific papers and discussions, while the local branch meetings would be more of a professional character. It is possible that the Sciences Club might ultimately become the scientific expression of the Adelaide branch of the A.I.A.S.,—not all its members, however, necessarily being members of the Australian Institute.

Several distinguished persons have visited the Waite Institute recently, including Lord Sempill, President of the London Chamber of Commerce, who spent two or three days as the guest of Professor Richardson; Sir Arnold Theiler, formerly Director of the Veterinary Research Institute at Onderstepoort, S. Africa; Sir Archibald Weigall; Sir William and Lady Sowden; and Professor H. C. Richards, of Queensland.

The Sydney University Agricultural Graduates Association

The annual general meeting of the Association was held at Science House on February 8, 1935. The President, Mr. G. de V. Davis, occupied the chair. There was an attendance of 30 members. The minutes of the previous meeting were read and confirmed. The financial statement for the year showed: Receipts, £66/7/8; Expnditure, £41/8/6; Credit Balance, £24/19/2. The Secretary stated that the enrolment of financial members for the year totalled 84,—a record. The President outlined various matters which had come up for discussion in Melbourne concerning the Constitution of the Australian Institute of Agricultural Science. Members evinced a keen interest in the formation of the new body, and the Secretary was instructed to apply to Melbourne for registration of S.U.A.G.A. as the N.S.W. branch of the Institute The necessity for agricultural representation on

the N.S.W. Council of Education was discussed, and it was agreed that the matter shuld be brought under the notice of the Minister for Education. Professor R. D. Watt and Messrs. E. T. Edwards and H. J. Hynes were appointed as a committee to consider modifications of the Constitution of S.U.A.G.A., so that it would be compatible with that of the Australian Institute.

The President then delivered his presidential address on "Commerce and Agricultural Research," an abstract of which is published elsewhere in this issue.

The election of office-bearers for the ensuing year resulted as follows:—President, Professor R. D. Watt; Vice-President, Mr. G. de V. Davis; Hon. Secretary, Mr. E. T. Edwards; Hon. Treasurer, Mr. N. S. Noble; Hon. Assistant Secretary-Treasurer, Mr. H. P. Brown; Committee, Mr. H. J. Hynes and Mr. D. R. L. Steindl.

Current Notes and News

SIR DAVID RIVETT

We congratulate Sir David Rivett on the Commonwealth honour of K.C.M.G., conferred on him by the King in January last; also on his election as President of the Australian and New Zealand Association for the Advancement of Science. Sir David has had a most distinguished career in both academic and executive spheres of work, and no scientist was more deserving of the honours recently conferred.

Albert Cherbury David Rivett was born in Tasmania in 1885, and was educated at Wesley College, Melbourne, Queen's College, Melbourne University, Lincoln College, Oxford, and the Nobel Institute, Stockholm. His degrees are M.A., B.Sc. (Oxon.), D.Sc.(Melb.). He was Victorian Rhodes Scholar in 1907, and in 1911 was appointed Lecturer in Chemistry at Melbourne University,—being appointed Assoc. Professor in 1921 and Professor in 1924. As is well known, Sir David is Deputy Chairman and Chief Executive Officer of the Commonwealth Council for Scientific and Industrial Research. When the British Assoc. for the Advancement of Science met in Australia in 1914 he was the General Organising Secretary. During the war he was Registrar of the Australian General First and Second Hospitals in England, and later was Process Manager of the Munitions Factory at Swindon, England. Lady Rivett is a daughter of the late Hon. Alfred Deakin.

Dr. WALTER L. WATERHOUSE

We are pleased to record that at the Annual Meeting of the Linnean Society of N.S.W. this month, Dr. W. L. Waterhouse was elected President for the ensuing year, in succession to Professor W. J. Dakin This is an honour for one who is at the same time a most distinguished graduate in agriculture from Sydney and one of the foremost plant pathologists in Australasia. He graduated B.Sc.Agr. with first-class honours and the University Medal in 1915, and straightway surrendered his 1851 Exhibition Scholarship in order to enlist; he was awarded the Military Cross in 1916 at Pozieres. In 1918, as Walter and Eliza Hall Agriculture Research Fellow, he undertook advanced studies and research at the Imperial College of Science and Technology, London, and was awarded the D.I.C. in 1920.

Since 1921, Dr. Waterhouse has been Lecturer in Plant Pathology, Genetics and Plant Breeding, and Agricultural Botany at Sydney, and is regarded as one of the best teachers in the University. His special line of research is cereal rust diseases, and his thesis on this subject for the D.Sc.Agr. degree—awarded in 1929—was reported by the examiners to be of a very high order of merit, from both the genetical and mycological standpoints. The inspirational nature of his lectures has caused many a student to select either plant pathology or plant breeding as a subject for further study, and it was indeed fortunate for Australia that he did not accept the offer of the professorship which came to him from London University in 1924.

FACULTY OF AGRICULTURE NEWS

Ten graduates from Melbourne will take out their degrees this year. Mr. J. G. Baldwin was the most successful student,—winning the Wrixon Exhibition and the Henry Gyles Turner Scholarship. Of the ten, Miss Dann will relieve G. Loftus Hills, who is abroad; Mr. C. J. R. Johnston will remain in the Dept. of Agriculture; while Mr. H. Dickenson has been appointed as Science Field Officer in the same Department. Other appointments are expected shortly.

Four men qualified for the B.Agr.Sc. degree at Adelaide in 1934. Messrs. D. S. Riceman and G. D. Hubble are temporarily engaged in field work at the Waite Institute; Mr. J. C. F. Fornachon is carrying out bacteriological work on wine; and Mr. L. H. Laffer has proceeded to the Education Dept. Mr. W. H. McFarlane has yet to pass a supplementary examination before qualifying for his degree

Twelve students sat for the final degree examinations in agriculture at Sydney last December, nine of whom passed in all subjects; the remaining three were given "posts" in minor subjects. Mr. F. W. Hely graduated with first-class honours, and is now on the C.S.I.R. staff as Plant Pathologist in connection with tobacco investigations. Messrs. Holman, Steindl, Fyfe and Gurdon each graduated with second-class honours, and expect appointments shortly. The five Teachers' Training College Scholars who completed the degree course, have already been placed in various schools throughout the State.

It was recently announced in the Sydney Press that by the will of the late Mr. J. N. Garland, £64,000 had been left for the purpose of furthering the study of agriculture, veterinary science, grazing pursuits, or forestry, or any of those subjects. The trust is known as the Neill Garland Trust.

Mr. S. FISH

We congratulate Mr. Stanislaus Fish on his appointment in January as Biologist, in charge of the Plant Research Laboratory, Victorian Dept. of Agriculture. He is 32 years of age and graduated B.Agr.Sc. at Melbourne in 1926, being then appointed Assistant Plant Pathologist. In 1928 he was awarded the M.Agr.Sc. degree for a thesis on transportation rots of stone fruits and apricot scab. He represented the State Department at the Canberra Quarantine Conference last year, and he is a member of two joint committees of the C.S.I.R. and the Victorian Department,—those dealing with Fruit Storage Investigations and Oriental Peach Moth Investigations.

Mr. J. W. EVANS

Best wishes are extended to Mr. J. W. Evans, M.A., in his new sphere as Entomologist to the Tasmanian Dept of Agriculture at Hobart. Mr. Evans had been associated with the C.S.I.R. for eight years, during which he spent two years at the Cawthron Institute, N.Z., the Farnum Royal Parasite Laboratory, England, and various other laboratories in America and on the Continent. Prior to the commencement of the work at the Waite Institute dealing with the prediction and control of thrips—on which he was engaged for three years up to the time of his recent appointment—he worked at Canberra.

Personal Notes

CANBERRA, F.C.T.

Dr. B. T. Dickson, accompanied by Mr. Ramsay, Potato Expert of the Victorian Dept. of Agriculture, spent the last week of January in a survey of the potato areas of Western Victoria, determining the incidence of virus diseases. Mr. S. Fish joined in the latter part of the survey.

Mr. C. R. Mulhearn, who has been with the C.S.I.R. for seven years on blowfly work, has accepted a position as a veterinary officer in Queensland. He will work at the Yeerongpilly Animal Health Station, Brisbane.

Mr. J. R. A. McMillan recently returned from a visit to Western Australia. He then left for Gatton College, Q., to inspect the maize work there.

NEW SOUTH WALES

Dr. T. H. Harrison has been awarded the Diploma of Membership of the Imperial College of Science and Technology, London,—carrying the academic distinction, D.I.C. This has been granted for his researches on fruit-rotting fungi, conducted during his tenure of the Ben Fuller Scholarship in London in 1930-32.

Mr. T. E. Kitamura has been appointed Agricultural Master at the All Saints' Church of England College, Bathurst.

Mr. G. de Vahl Davis, with his family, sailed by the "Moldavia" on February 21 for England and the Continent. He will be away for about eight months and will visit leading agricultural research centres abroad.

Mr. C. K. Vears spent part of his annual vacation in Tasmania, and resumed duty at the Wagga Experiment Farm towards the end of February.

Mr. E. G. Pont has had a very successful period of research at the National Institute for Research in Dairying, and will shortly leave for U.S.A. to continue his studies under Drs. Breed, Hucker and Hammer.

Mr. L. S. Cayzer writes to say that he is thoroughly enjoying his stay at Minnesota, U.S.A., where he is studying advanced chemistry under Drs. Gortner and Bailey, and advanced biometry under Dr. Treloar.

The Citrus Fruit Preservation Committee met in Sydney in February and was attended by Prof. W. J. Young, Dr. J. R. Vickery and Messrs. C. G. Savage, F. M. Read, A. G. Strickland, E. S. West, F C. McCleery and R. J. Benton. Miss Archer was present as Secretary.

The Lucas-Tooth Scholarship for 1935 has been awarded to the Rev. A. B. Catley, M.Sc., B.Sc.Agr., who is chaplain at the Armidale School, Armidale, and who was nominated by the Bishop of Armidale. Mr. Catley will proceed to Cambridge, where he will study theology.

VICTORIA

Mr. J. F. Kennedy and Mr. E. D. Cameron have joined the staff of Australian Estates and Mortgage Co. Pty. Ltd., the former to study animal nutrition and the pastures of the Company's Central Queensland stations, the latter to work on the sugar property at Townsville.

Mr. L. Provan has been promoted to the position of Horticultural Research Officer in the Dept. of Agriculture.

Mr. A. J. Vasey was married in Sydney in February.

SOUTH AUSTRALIA

Professor J. A. Prescott returned to the Waite Research Institute on January 12, after spending about nine months abroad. He attended the Soil Physics Section of the International Society of Soil Science at Versailles, where the French Ministry of Agriculture is developing its primary research centre, and called in at various research institutes in France and Belgium, and at the Superphosphate Research Station at Hambourg. After joining a party under the leadership of Sir John Russell, and organised by the Le Play Society of London, which covered some 3,000 miles in the Soviet Union, he spent several weeks at Rothamsted. An interesting meeting took place at Cambridge where Prof. Prescott and Messrs. Samuel, Bald, Ballard and Dawson foregathered in the Botany School.

Mr. R. F. Williams, who has been conducting post-graduate work in plant physiology at the "Waite" under Dr. A. H. K. Petrie, has been appointed Assistant Plant Physiologist in succession to Mr. L. A. T. Ballard. His work has been concerned mainly with the intake and drift of phosphorus in gramineous plants.

Mr. T. T. Colquhoun, who has been Assistant Lecturer in Botany at Adelaide, commenced duty as Assistant in Plant Pathology at the Waite Institute in January.

Mr. E. J. A. Crabtree, of the Fairymead Sugar Co., Bundaberg, Q., is doing post-graduate work in the C.S.I.R. Division of Soils at the "Waite." He is particularly interested in soil problems and experimental technique.

OTHER STATES

Professor and Mrs. J. K. Murray, of Queensland, attended the Science Congress in Melbourne in January, the Professor officiating as President of the Agriculture and Forestry Section.

Mr. E. R. Hudson and Mr. E. F. Fricke of Tasmania, and Mr. A. J. Roberts of Western Australia, also were present at the Congress. Mr. Hudson read a most interesting paper on Rural Relief, and this is published in condensed form elsewhere in this issue.

SERVICE

THE Rural Bank is a national Institution enabling farms and homes to be acquired on easy terms. It thereby fosters increased production and home-building and helps to consolidate the position of our State and Commonwealth. ¶ The Bank is guaranteed by the State Government against loss, but although its activities date back to 1899 it has at no time made a claim under this guarantee. In fact from consistent but moderate profits it has built up reserves exceeding £1,250,000 (invested outside the business of the Bank). ¶ Branches are established at representative centres, where Fixed Deposits are received and cheque accounts opened for ALL sections of the community. Those who bank with the Rural Bank appreciate that by so doing they are enabling it to increase its useful activities.

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